# PLANT PROTECTION BULLETIN

A Publication of the
WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

VOL. VI, No. 12 SEPTEMBER 1958

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME

COMMONWEALTH MYCOLOGICAL INSTITUTE
15 DEC 1958

## FAO PLANT PROTECTION BULLETIN

is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

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The Bulletin is issued monthly in English, French, and Spanish, and twelve numbers, commencing with the October issue in each year, constitute a volume. Subscription rates are $ 3.00 or 15s. per annum; single numbers are priced at $ 0.30 or 1s. 6d. The citation is FAO Plant Protection Bulletin, or, in abbreviation, FAO Plant Prot. Bull.

## YEARBOOK OF FOOD AND AGRICULTURAL STATISTICS

## 1957

### (Volume XI, Part 2)

The 1957 issue of the Yearbook includes data for the years 1955 and 1956, thus providing statistics for the period not reported previously.

In general contrast and arrangement, the 1957 Yearbook is similar to that of 1955 and preceding issues, with broad sections on Value of Agricultural Trade, Commodities, Trade of Non-reporting Countries, Commodity News and Country Notes. There are, however, a number of changes of interest to readers. Statistics for several additional countries are shown in tables on value of trade, and the principal table has been revised to treat agricultural requisites as nonagricultural (rather than agricultural) products. An average for the years 1948-52 has been substituted for the 1948-50 average.

Official figures for 1954-56 for Bulgaria, Hungary and Poland are shown in the commodity tables, with additional data given in the Country Notes. There is a new table on trade in shell eggs, while plantains have been included in the table for bananas; that for natural rubber now deals with trade in similar gums (balata, gutta-percha, etc.).

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FAO Plant Protection Bulletin

Vol. VI, No. 12 A Publication of the September 1958

World Reporting Service on Plant Diseases and Pests

# Eradication Measures Against the Oriental Fruit Moth in the Province of British Columbia, Canada [1]

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The oriental fruit moth, *Grapholitha molesta* (Busck), has never been recorded as established in British Columbia, although the insect has been present to the south in certain fruit-growing areas of the State of Washington, U.S.A. A quarantine against this insect has been enforced by the Canadian Government which requires, among other provisions, that all fresh fruits entering British Columbia from the United States be fumigated with methyl bromide, in accordance with a published treatment schedule, unless they are accompanied by the certificate of a recognized federal or state inspector declaring that the fruits originated in a nursery, orchard, or other source, in a district in which the insect is not known to occur. Fumigated shipments must be accompanied by official certificates showing that the treatment has been properly carried out in accordance with the prescribed schedule.

In September 1956, living larvae of this insect were discovered in peaches trucked from Yakima, Washington, to a cannery at Summerland in the Okanagan fruit-growing district of British Columbia. The shipments had been accompanied by official fumigation certificates and the presence of living insects was attributed to fumigation failure of unknown cause. Before the discovery of the insects, some fruit debris from processed fruits in the shipment which could have contained living larvae, had been distributed through an adjacent 8-acre orchard to build up the organic content of the soil.

The Canadian and British Columbia Departments of Agriculture collaborated immediately in an attempt to eradicate the insect while there was still a fair chance of success. The federal activities were carried out by the Plant Protection Division of the Production Service and the Entomology Division of Science Service, Canada Department of Agriculture. Valuable assistance was also afforded by the Plant Pest Control Division, United States Department of Agriculture, in providing technical advice for the fumigation of the canneries involved and in lending additional instruments and accessories for fumigant analysis.

In addition to the known presence of this insect in the cannery and adjoining orchard at West Summerland, there was evidence that infested peaches may have been shipped to another cannery at Osoyoos, British Columbia, near the Canadian-United States border. Refuse from this cannery had been poured into adjoining settling pits, or thrown into the Osoyoos town dump some miles away.

It was decided to fumigate the two cannery buildings, the orchard area at West Summerland, the settling pits and town dump at Osoyoos, all with methyl bromide under tarpaulins. The fumigation of the cannery buildings was a routine procedure, already satisfactorily developed for the khapra beetle campaign in the western United States.[2] Eradication of the insects in the orchard area presented a special problem.

[1] Contribution No. 136, Science Service Laboratory, Canada Department of Agriculture, London, Ontario.

[2] Armitage, H. M. 1956. The khapra beetle problem in California. *Jour. Econ. Ent.* 49 : 490-493.

### *Biological Considerations*

When the infestation was discovered in the peaches, only larvae were seen. The season was late, making it unlikely that any further development would take place. Measures undertaken would have to be directed against the hibernating larvae spun up in cocoons (hibernacula) formed in crevices on the rough bark of trees, in weed stems, in trash on the soil, in orchard boxes, and in cracks in and around buildings. It was considered unlikely that a larva would crawl more than 1 foot up the trunk of a tree before constructing a hibernaculum. Although the larva does not actively bury itself in the soil, there was a possibility that it might hibernate in a crack down to 1 inch below the surface.

It was obviously necessary to do the eradication work in the early spring of 1957, before adult emergence. In the present range of distribution of the insect the moths start to fly at the time of the appearance of the earliest peach blossoms. Therefore, on the basis of available phenological data for the Okanagan district, the work would have had to be completed by the middle of April. Air and soil temperatures were too low before the middle of March, and therefore it was necessary to complete the entire project within one month. As a result of concerted and continuous effort the work was actually completed by 10 April, well before the appearance of the peach blossoms in that particular season.

As it was clearly inadvisable to transport living stages of *Grapholitha molesta* from Ontario to British Columbia to serve as checks on the effectiveness of the treatments, the mature larvae of the cadelle *Tenebroides mauritanicus* L. were used for this purpose. These insects are very suitable for use as test insects under field conditions and, in experiments performed at this laboratory, were found to require for complete mortality four times the dosage needed to kill the larvae or pupae of *Grapholitha molesta* in the hibernacula.

### *Treatment in Canneries and Dumps*

The two canneries were successfully fumigated under tarpaulins of plasticized nylon. Temperatures within the buildings ranged between 40° and 50° F., during the 48-hour exposure periods. The concentrations of fumigant at sampling stations throughout the structures were measured regularly by means of thermal conductivity analyzers. This analysis, and the fact that all the cadelle larvae used as test insects were killed, indicated that complete control would have been effected of all stages of oriental fruit moth larvae present in the buildings.

The town dump and the settling pits at Osoyoos were also effectively fumigated under the tarpaulins.

### *Treatment of Orchard Area*

The techniques employed and the results obtained in the treatment of the orchard area have been described in detail elsewhere.[3]

Before the orchard fumigation the removal of entire trees, including the roots, involved the danger of burying hibernacula; therefore, the trees were cut down, leaving 1 foot of stump. These stumps would retain any hibernacula which might be on the trees and also serve as supports for the tarpaulins. During the late winter the trees were cut and burned on the spot.

The strong plasticized nylon fabric used on the buildings was also used for soil fumigation. This enabled the fumigant to reach any hibernacula on the stumps and provided a head space for even distribution of the fumigant. To prevent cutting of fabric, the stumps were covered with cardboard pie plates and later by pieces of burlap. Orchard boxes were also placed at suitable intervals between the stumps to prevent sagging of the tarpaulins. The tarpaulins, usually 50 by 50 feet square, were clamped together to cover the required areas. The outer edges were buried in trenches 6 inches deep.

The area of approximately 8 acres was fumigated in 26 separate sections. At the beginning of the work large areas of 1 acre were covered. It was soon found that smaller areas, preferably six tarpaulins in length and one in width, were managed more easily. With the smaller areas a new section could be covered more quickly by leaving one edge

[3] MONRO, H. A. U. 1958. Suppression of oriental fruit moth in British Columbia. *Down to Earth*, 13 (4): 16-20.

undisturbed in the trench and pulling the tarpaulin over an adjoining strip of ground During all treatments the concentrations of methyl bromide in the free air space beneath. the tarpaulins were checked at regular intervals by means of thermal conductivity gas analyzers. These readings made it possible to judge the amount of additional fumigant required, if any, to sustain the concentrations at the level needed to bring about complete kill of the insects above ground level and down to 2 inches below the soil surface. Soil temperatures taken at 1 inch below ground level ranged between 33° and 51° F.

Results obtained from the use of the cadelle larvae indicated that, taking into consideration the resistance to methyl bromide of this insect in comparison with that of the hibernacula of the oriental fruit moth, the population of the latter insect would have been destroyed in those areas actually fumigated, down to 2 inches below the soil surface. The amount of fumigant required to produce the desired results varied greatly according to the terrain of the different sections and the daily changes in weather.

Five tons of methyl bromide were applied under the tarpaulins during the fumigation. The average dosage was 23.3 pounds per 1,000 square feet. The mean concentration sustained in these fumigations in the free space under the tarpaulins, as recorded for the first 24 hours of each treatment, was 22.3 ounces per 1,000 cubic feet.

### *Spraying and Trapping in 1957*

Following completion of the fumigation work, an intensive spray program was undertaken in surrounding orchards with DDT. At the same time organized trapping was instituted throughout the Okanagan fruit-growing area. At the close of the season no moths had been recovered at any trapping point, nor had there been any report of the presence of any stage of the insect. These negative findings will have to be corroborated by several years of continuous trapping throughout the suspected areas.

# Citrus Virus Diseases in the Mediterranean and the New World [1]

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THE two virus diseases which cause great concern to citrus growers as well as citrus experts throughout the world are xyloporosis and tristeza. The former was discovered in Palestine in 1928 (18), and the latter was described about ten years later in South America (1, 10) and South Africa (9, 12). Both maladies have specific destructive characteristics: xyloporosis brings about decline of all citrus varieties when grafted on sweet lime, whereas tristeza shows its destructive effect on citrus plants when grafted on sour orange. The tristeza-affected countries have thus been compelled to discard sour orange as a rootstock and to replace it with other rootstocks. The eastern Mediterranean countries have also had to discontinue the use of the sweet lime rootstock because of its strong susceptibility to xyloporosis and to replace it with sour orange, either alone or in combination with sweet lime, by means of inarching (18).

The sudden discovery of the tristeza disease and its virulence in trees grafted on sour orange in the tropical and subtropical countries has aroused great fear in all the Mediterranean countries where citrus trees are now grafted on the xyloporosis-tolerant sour orange. Should the disease be introduced and become established in the Mediterranean, the citrus growers could thus be deprived of a valuable rootstock. The only hope that tristeza may not be established in this area is based on the fact that the vector of this destructive disease, *Aphis citricidus*, which is indigenous to the tropics, is not known to exist in the Mediterranean region.

Neither has *Aphis citricidus* been found in the United States. It was therefore supposed that the relatively small number of tristeza-infected trees in California and Florida is mainly a result of using infected budwood imported from tristeza-affected countries (20). No other efficient insect vector of this disease has been discovered either in the United States or in the Mediterranean region. This was the status of knowledge on these two main citrus virus diseases a year or two ago.

To summarize, xyloporosis was considered to be confined to the eastern Mediterranean with some sporadic occurrences in the New World. Tristeza has been spreading mainly in tropical or subtropical countries where *Aphis citricidus* is indigenous. Until very recently the actual distribution of xyloporosis and the extent of its damage in the western Mediterranean and in the New World were not known. New findings made in Florida in 1957 (11), together with the writer's investigations in the western Mediterranean[2] and also in the United States, however, have contributed much to clarify the situation and to effect a change of view.

## *New Findings of Xyloporosis*

A significant change in knowledge has occurred with regard to the prevalence of xyloporosis. Until a year ago, it was thought that this disease would not spread, or that it was of minor importance in countries where sour orange was used as a standard rootstock. New studies by the writer have shown, however, that this disease is very common in such countries and that even citrus trees grafted on sour orange rootstock may be heavily affected by xyloporosis.

The first finding, that citrus trees grafted on sour orange were affected by xyloporosis, was made in Palestine in 1928 and the disorder was described under the name of "little leaf" (17). This occurred at the same time that

[1] Paper delivered at the Rockefeller Institute in New York, 24 February 1958.

[2] REICHERT, I. A report on the results of the survey of citrus virus diseases in the Mediterranean countries, 1957, organized by the European and Mediterranean Plant Protection Organisation (EPPO). Unpublished.

xyloporosis was discovered on sweet lime. The disease named "little leaf" showed a much greater number of pronounced lopsided fruit but with less pronounced pitting at the bud union than xyloporosis, which was then known to appear only on sweet oranges grafted on sweet lime. This "little leaf" disorder was at that time considered a disease different from xyloporosis but later the two were regarded as identical, the small differences in the symptoms being a result of the genetical variations in the types of rootstock (14, 15, 19). A heavy outbreak of "little leaf" on young citrus plants grafted on sour orange was brought about by adverse climatic conditions in 1928, with extremely hot, dry winds continuing for five days. Such conditions also contributed in the same year to the epidemic occurrence of xyloporosis in orange trees grafted on sweet lime (17). Under normal climate, the Israeli strain of sour orange is in general tolerant to xyloporosis when grafted to sour orange. Only mandarin varieties when grafted on sour orange suffer from xyloporosis (16).

The damage of xyloporosis in Israel, Lebanon, Syria and southern Turkey, as noticed by the writer during his visits in 1933, was mainly in sweet orange grafted on sweet lime (18). In more recent years, sweet lime seems to have been abandoned as a rootstock in favor of sour orange. However, in 1957 the writer again received inquiries from citrus experts in these countries about abnormal fruit appearing there. The specimens obtained from them proved to be fruit typical of those from "little leaf"-affected orange trees grafted on sour orange.

The exploratory tour made by the writer in 1957 in most of the important citrus-growing countries in the Mediterranean (Cyprus, Greece, Yugoslavia, Italy, Spain and France) organized by EPPO furnished evidence to confirm his previous observations that young or old trees grafted on sour orange may show signs of tree decline, lopsided fruit, "little leaf" and pitting at the bud union – all symptoms previously described as characteristic of the "little leaf" disorder of orange trees in Palestine.[3] Similar decline of the "little leaf" type was also reported by Childs (5), under the name of xyloporosis, on many citrus varieties grafted on sour orange in Egypt. In western North Africa, Turkey and Lebanon, the occurrence of decline and malformation of fruit of sweet orange trees grafted on sour orange was observed by Chapot (3), who even mentioned that the budwood of the diseased trees in Turkey and Lebanon was introduced from Palestine. All these data reveal that xyloporosis is not confined to the eastern Mediterranean region, nor to trees grafted on sweet lime, as previously thought. On the contrary, the disease proved to be widely distributed throughout the whole Mediterranean region, attacking, in addition to citrus trees grafted on sweet lime, also those grafted on sour orange.

The most surprising discovery with regard to the distribution of xyloporosis came from the New World. In 1948, Webber (21) referred to xyloporosis as a disease of sporadic occurrence in the United States. Several years later, an extensive budwood certification scheme was initiated in Florida under the auspices of the State Plant Board, and carried out under Norman (4, 11). Commercial varieties of sweet orange and grapefruit, which were usually grafted on sour orange, were registered and indexed on Mexican lime and Orlando tangelo. Among the trees considered to be "a representative cross section of the state's citrus trees," Norman found 72 percent infected with xyloporosis but only 5.5 percent with tristeza (11). Many of the trees carrying xyloporosis did not show signs of decline. However, such affected trees would be liable to decline under adverse external conditions. The majority of citrus trees in Florida were thus proved to be infected by xyloporosis. Very recently the writer examined many grapefruit and other citrus trees in Florida and found that the trees examined were very nearly all infected by xyloporosis.

A similar situation occurs in Texas, where Olson (13) first proved experimentally the widespread incidence of xyloporosis in healthy-looking red grapefruit trees grafted on sour orange. During the writer's recent visit, many grapefruit trees of the red line and Marsh varieties, showing various degrees of decline, were observed. These trees all showed pronounced xyloporotic pitting symptoms at the bud union. Here again, the majority of

[3] REICHERT, I. A survey of the citrus diseases in the Mediterranean area. *Proc. Conference on Citrus Virus Diseases, 1957.*

the trees were obviously affected by xyloporosis, the declining phase of which would develop when growth conditions became unfavorable.

No information based upon direct observations or experiments on the incidence of xyloporosis in citrus varieties grafted on sour orange has been available from Arizona and California. On the other hand, the citrus trees in these two states are known to be affected by a virus disease referred to as "stubborn." This disease was proved in 1944 by Fawcett *et al.* (8) to be transmissible. Symptoms of the "stubborn" disease, according to various observers,[4] are the acorn-shaped fruits and the blued albedo of the fruits, accompanied by a slow decline, off-bloom twiggy, dwarf growth and partial defoliation.

Since the "stubborn" disease was described, the question as to its possible identity with "little leaf" in Palestine, as indicated by Fawcett and Klotz (7), has arisen. After the widespread incidence of xyloporosis was demonstrated by the budwood certification survey in Florida and by Olson's experiments and the writer's observations in Florida and Texas, there is reason to believe that xyloporosis must have been overlooked in Arizona and California and that the virus disease known as "stubborn" might be identical to xyloporosis.

The writer's recent visit to California and Arizona apparently strengthened this belief. The "stubborn" disease in these two states is being thoroughly studied by Dr. J. Carpenter, who was kind enough to invite the writer to visit his "stubborn"-affected experimental citrus plantings in both states. During these visits a great number of trees were examined for their bud union condition and the nature of the fruit, and it was found that all trees of grapefruit and other citrus varieties affected with "stubborn" showed typical xyloporotic pitting and lopsided fruit, both symptoms typical of xyloporosis. Only a small number of fruit showed blueing in the rind and became acorn-formed. These characteristics differ from those of "little leaf" in Israel only in that the affected fruit in Israel has never shown blueing in the rind. However, even in Arizona and California, this symptom seldom appears. In recent experiments carried out by Carpenter and Hield (2) with trees sprayed with the growth regulator 2, 4, 5 - T, the results appear to indicate that blueing is rather a physiological reaction than a symptom caused by virus infection. Carpenter[4] also observed that the blueing appears in Frost Nucellar Marsh grapefruit. If it is a symptom of a virus disease, the blueing should not occur in the nucellars, as virus diseases are not yet known to be transmitted through nucellars. Its appearance in the nucellars seems to indicate that it is a reaction to some unknown factors other than virus.

Another indication that "stubborn" is identical to xyloporosis may be found in the experiments of Olson (13) and Norman (11), who found that the old grapefruit lines, which were used in their grafting experiments on Orlando tangelo, were almost invariably infected with xyloporosis. The same grapefruit lines were considered by Carpenter (*loc. cit.*) as the main carrier of "stubborn." It is hoped that Dr. Carpenter's extensive grafting experiments will provide a conclusion with regard to the nature of "stubborn."

From the foregoing it may be concluded that xyloporosis is widespread in California and Arizona, and the number of xyloporosis-infected trees would certainly be no less than the 60 to 70 percent reported by Norman (11) for Florida. According to the writer's observations, a fair number of these trees manifest serious symptoms of decline with abundant lopsided fruits, defoliation and withered tip. Should conditions favorable to the disease development occur, the disease may spread to trees thus far manifesting a healthy appearance.

### *Discussion*

The observations and considerations presented in this paper have far-reaching significance on citriculture in the Mediterranean region and the United States. In both areas an efficient insect vector of tristeza is not known to exist. In the United States the tristeza disease can be held in check by stringent quarantine measures, budwood certification and the eventual eradication of infected trees. Therefore, the disease does not present, either to the United States or to the Mediterranean region, any great danger in

[4] CARPENTER, J. B. *Stubborn disease in grapefruit.* Unpublished.

the near future, especially if precautionary regulatory practices are adopted. On the other hand, xyloporosis presents a far more serious problem to the citrus industry in these areas, particularly the United States.

As a result of these findings, the concept regarding the distribution and prevalence of xyloporosis has been changed. In 1952, Ducharme (6) regarded xyloporosis as a minor disease in Florida citriculture, because the sweet lemon was not a commonly used rootstock; now it has become known that xyloporosis also attacks the sour orange rootstock in Florida and elsewhere in the United States. In fact, the sour orange rootstock in the United States appears to possess even greater susceptibility to xyloporosis than that in the Mediterranean. Therefore, the citrus industry in both areas will have to take measures to meet the challenge of the disease.

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# Progress on Fruit Fly Control in São Paulo, Brazil

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THE fruit fly (Tripetidae) population infesting orchards in the State of São Paulo is composed of the exotic Mediterranean fruit fly (*Ceratitis capitata* Wied.) and the indigenous *Anastrepha* species. Only a few native species cause losses of economic significance, *Anastrepha mombinpraeoptans* Sein. being the most important. This species, together with the Mediterranean fruit fly, are responsible for the enormous losses in fruit production in São Paulo.

In general, mixed infestation of these two insect species occurs, and one or the other may prevail, according to the time of the year and the presence of fruits of certain hosts.

Surveys in coffee plantations showed that coffee berries are attacked mainly by *Ceratitis capitata* (Figure 1). Coffee plantations are therefore considered as the main reservoir of *C. capitata*. On the other hand, in peach, medlar and kaki orchards and on cultivated and wild species of Myrtaceae, *Anastrepha mombinpraeoptans* outnumbers *C. capitata* at a rate of 4 to 1 (Figure 2). In citrus plantations, it was observed that the composition of the fruit fly population depends on the species of neighboring host plants. Citrus orchards in the vicinity of coffee plantations are attacked mostly by *C. capitata*. On the other hand, in areas where coffee is not grown, citrus orchards near peach, kaki, medlar or Myrtaceous plants, *Anastrepha* species are predominant.

## *Factors Affecting Intensity of Infestation*

Under conditions prevailing in the State of São Paulo, the development of the fruit fly population is relatively little influenced by climatic and biological factors, such as the number of generations of the insect and the presence of parasites, but the availability of

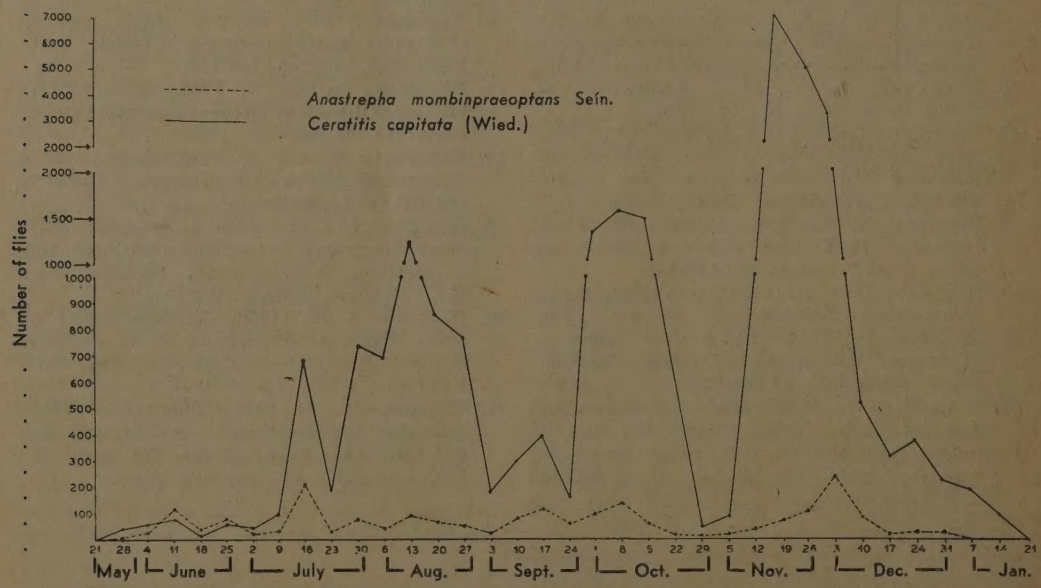


*Figure 1.* — Relative prevalence of *Ceratitis capitata* and *Anastrepha mombinpraeoptans* in a coffee plantation, São Paulo, Brazil, during a period of 35 weeks.

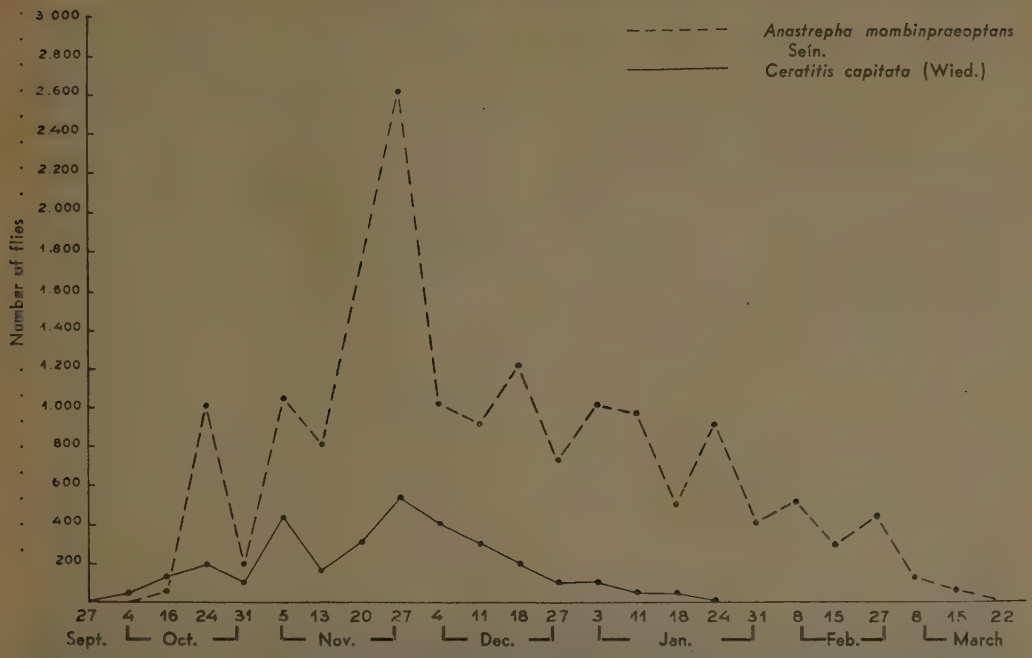


*Figure 2.* — Relative prevalence of *Ceratitis capitata* and *Anastrepha mombinpraeoptans* in a peach orchard, São Paulo, Brazil, during a period of 23 weeks.

susceptible fruit is the principal limiting factor. The presence of a large number of host plants with fruit maturing at different times of the year enables the fruit fly to perpetuate, to propagate and build up a high population. The existence of a single host species with fruits maturing over a long period is equally favorable to the increase of the flies.

In small areas, the concentration of various crops susceptible to fruit fly results in such high infestation as to limit fruit growing in São Paulo. Under such conditions, the flies may breed throughout the year because of the continuous presence of susceptible fruits, and therefore interruption of the succession of mature fruits is the only natural means of restricting the fruit fly population.

### *Liquid Attractants for Traps*

Investigations have been carried out for some years to find an inexpensive substance available in the country for use as an attractant in fruit fly traps. A 5 to 7 percent solution of brown sugar without addition of insecticides or preservatives showed the best results (8). This material is now used for ecological studies to determine migration, intensity of infestation, etc. It is also useful in determining the right time for the application of bait sprays.

The possibility of using traps to control fruit flies has also been studied. From the few tests made, traps appeared to be ineffective for fruit fly control (7). Even with eight traps on each peach tree the number of attacked fruits remained extremely high. A large field trial in citrus orchards with 40,000 traps and renewal of the lure every week did not give satisfactory results.

### *Bait Sprays*

Among methods developed for fruit fly control, those using poisoned bait sprays appeared to be most promising under the conditions prevailing in the State of São Paulo.

In developing methods for mass production of fruit flies in Hawaii, Finney and Hagen (1,2) found that adults feeding on sugar, fruit juice or water did not attain sexual maturity until after three weeks and the

number of eggs produced was small. Studies on feeding habits of adult flies in the field showed that they prefer the excretion of coccids to other sources of food. Chemical analysis indicated that besides hydrocarbons, the excretion contains a considerable amount of amino acids. Feeding on a diet enriched with amino acids, flies attained sexual maturity within eight to nine days and egg deposition was high. Later it was found that various protein hydrolyzates sprayed on leaves as bait were very attractive to fruit flies and that a lethal dose of insecticide mixed with the bait would be consumed by the flies.

Following these reports, the use of bait spray as a means of controlling fruit flies received considerable study in São Paulo.

In the study of such attractants in Hawaii, Steiner (11) used trays 3 feet square placed under terminal branches of trees which were sprayed with 5 to 10 cc. of poisoned bait spray. The insecticides applied were phosphorous compounds with a good knockdown effect, and the dead insects were collected in the tray. This method, while probably satisfactory for comparing weak and strong attractants such as sugar and some protein hydrolyzates, did not work well in São Paulo for the differentiation of such attractants as crystallized sugar, brown sugar, molasse, etc.

Therefore, a new method was developed, using Petri dishes with three invaginated holes 8 millimeters in diameter, permitting entrance to the flies (Figure 3). The dishes were sprayed on the inside with the bait spray under investigation and left to dry. Two to three such Petri dishes were then fixed with wire onto coffee trees. The number of captured flies indicated the relative effectiveness of the attractant, providing a basis for evaluating the results statistically (9). By this method, the value of protein hydro-

*Figure 3.* — Petri dishes with three invaginated holes, used for testing bait sprays in São Paulo.

lyzates as powerful attractants was confirmed. Also, it revealed sugar cane molasse as the best attractant among the inexpensive products available in Brazil.

After testing a great many substances, it was discovered that a hydrolyzate of concentrated corn steep liquor is comparable with the best protein hydrolyzates reported (6) in its attractiveness to the Mediterranean fruit fly. This product is readily available in Brazil and is inexpensive. Yeast formulations also gave good results but are too expensive for general use.

In Hawaii, and for the Mediterranean fruit fly eradication campaign in Florida, the most extensively used attractants were produced by acid hydrolysis of corn protein derived from by-products in corn starch and corn sirup production. Corn steep liquor is also a by-product of the corn processing industry, with a high content of amino acids. In hydrolized concentrated corn steep liquor, 17 different amino acids have been found.

### *Field Tests on Control of Fruit Flies with Bait Sprays*

Several field trials were carried out with poisoned bait sprays in citrus and peach orchards in order to compare insecticides commonly used in other countries against fruit flies and to determine the best way for application of poisoned bait sprays. Since the trials were made before hydrolized proteins were used, 5 percent molasse was applied as an attractant. The following insecticides at the indicated concentration of active ingredients gave the best results:

dieldrin – 0.1 percent
malathion – 0.2 "
parathion – 0.02 "

In orchards of more than 1 hectare in area the application of bait spray may be restricted to only one side of the trees, using an average of 250 liters of bait spray per hectare. Intervals between treatments must not exceed two weeks and shorter periods are required during the rainy season. In a test covering more than 10 hectares, control of 97 percent of the flies was obtained. For areas smaller than 1 hectare, the results were not satisfactory due to the continuous invasion by flies from outside.

### *Movement of Flies*

It is possible to determine the density of insects migrating from outside, on trees on the border and on those in the interior, by placing glass traps throughout an orchard. In citrus orchards, the number of flies trapped along the borders was significantly higher than in the center. In large orchards, it was sometimes difficult to find any flies in the center.

For efficient fruit fly control, an insecticide barrier should be drawn around the orchard, by spraying the border trees carefully and with a high rate of insecticide.

### *Observation on Design of Field Experiments*

In field experiments involving the use of bait sprays some difficulties are often encountered because of the habits of the flies, which prevent the evaluation of results by statistical methods. The principal difficulty is caused by the irregularity of infestation. This lack of uniformity of infestation in a given area is due to the migratory habits of the flies, a phenomenon which has been verified in all regions where fruit flies occur. This characteristic leads to an increase of insect population among adjacent plants, resulting in a higher infestation of trees on the borders of a given area. Furthermore, the flies are extremely mobile during the preoviposition period, moving among trees and crossing the border of adjacent plots. Such movement increases the irregularity of the infestation.

In trials laid out in latin squares, it was found that the central blocks were well protected by the surrounding treated blocks which acted as barriers, and the statistical interpretation of the results would not show significant differences between the treatments.

To minimize the effect of migration, a new rectangular design only two blocks in length and six or more blocks wide, according to the number of repetitions, was adopted. With this layout, significant differences between treated and nontreated blocks could be obtained. Another detail of these experiments, which could lead to uniform infestation in the whole test area, was the spraying of the control plot with the attractant only.

### *Soil Application of Insecticides*

A study of the habits of the fruit flies in São Paulo shows that, as in other countries, two types of infestation can be distinguished: one originates from surrounding orchards or nearby wild plants whose fruiting period has ended. From such orchards or plants, the flies invade orchards with fruit nearing maturity; these are called " migratory adults. " The other type of infestation originates from flies emerging from the soil within the orchard and are known as " sedentary adults. " It has been observed that the population of sedentary adults might be of importance especially in coffee and citrus plantations.

Fruit growers in São Paulo, particularly citrus growers, tend to cultivate several varieties of the same fruit, including early- and late-maturing varieties, to meet exigencies of the market. Those orchards where fruit susceptible to attack is available over a long period, facilitate the uninterrupted production of generations of flies and permit a heavy increase in the sedentary population. The same applies to coffee, with successive flowering periods and the presence of ripe cherries over a long period of the year. Little attention has been paid to fruit fly infestation but recently it has been suggested that the fruit fly infestation and the subsequent penetration of microorganisms through the lesions caused by the fly might reduce the value of coffee.

Soil treatment with insecticides to control pupae and emerging adults appears to be important as an auxiliary method for the control of fruit fly. Preliminary laboratory tests (5) show that aldrin applied at 7.5 part per million (9.5 grams of a 2.5 percent powder on 1 square meter of soil) killed all the pupae and emerging adults with a great residual effect. Chlordane at 12 parts per million was less effective and had a lower residual effect. Further tests are under way to ascertain the value of this method for fruit fly control.

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# Outbreaks and New Records

## Republic of the Philippines

G. M. Reyes and Benjamin M. Legaspi
Bureau of Plant Industry,
Department of Agriculture and
Natural Resources, Manila

### *Recent Records of Common Corn Smut*

The only specimen of the common corn smut, *Ustilago maydis*, that has ever been found on maize in recent years or that has come to the attention of the senior author for over three decades, was collected on a yellow flint variety by Mr. Felicisimo S. Maceda, provincial agriculturist, Bureau of Agricultural Extension, in his nursery in Dumaguete City, Province of Oriental Negros. It was said that this was the first time such infection was noticed on maize ear. The specimen was brought to Manila and referred to the Plant Pathology Laboratory in July 1955 for diagnosis by Mr. Victoriano Crucillo, a plant sanitation inspector of the Bureau of Plant Industry stationed in that province. About the middle of August 1955, the same disease was encountered by the junior author in Manila on a newly introduced flint maize variety, Binaga. The infection was also confined to the ear.

From literature available, it was found that the common corn smut had been recorded in the Philippines only twice, once by Reinking[1] and then by Welles.[2] Since then there had been no record of known outbreak of the disease anywhere in the Philippines, perhaps due to lack of a thorough and systematic plant disease survey.

[1] Reinking, O. A. 1918. Philippine economic-plant diseases. *Philipp. Jour. Sci.* 13:165-274.

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## Trinidad

Caribbean Commission
Port of Spain, Trinidad

### *Ceratostomella Canker Causing Death of Cacao Trees*

An outbreak of *Ceratostomella* canker, causing the death of a limited number of cacao trees, has occurred within recent months in certain areas of cacao cultivation in Trinidad, notably the northern and central ranges. This is the first recorded instance of death of trees from this cause.

The causal fungus, *Ceratostomella fimbriata*, although previously reported in cacao from Trinidad, has not until now been associated with *Xyleborus* shot hole borers, which combination appears to be the cause of death.

Simultaneous *Xyloborus* and *Ceratostomella* attacks have been the cause of some concern in recent years in Venezuela, Ecuador, Colombia and Costa Rica.

# Plant Quarantine Announcements

## Italy

A Ministerial Decree of 30 October 1957, published in the *Gazetta Ufficiale della Repubblica Italiana* No. 12 of 16 January 1958, amends and replaces Ministerial Decree of 1 July 1954 concerning importation and transit of plant material (see *FAO Plant Prot. Bull.* 3 : 22-29. 1954).

*Ports of entry.* Living plants, parts thereof, including seed and other propagating materials, fresh fruit, vegetables and other green stuff may be imported only through the following custom offices:

Railway stations: Ventimiglia, Modane, Domodossola, Luino, Chiasso, Fortezza. San Candido, Pontebba, Poggioreale.
Seaports: Genoa, Venice, Trieste, Leghorn, Civitavecchia, Naples, Bari, Brindisi, Taranto, Reggio Calabria, Messina, Palermo, Catania, Syracuse, Cagliari and Olbia.
Airport: Rome.

Samples of plants, parts thereof and seed may be imported through Florence.

*Entry prohibited.* The importation and transit of the following plant materials are prohibited:

1. Fruit-bearing plants, parts thereof and any fresh fruit from the Continent of America and adjacent islands, Africa (except Mediterranean area), Australia, China, Japan, the Philippines, India, and Pakistan, on account of the exotic fruit flies (*Anastrepha* and *Dacus* spp.), *Rhagoletis pomonella*, *Plowrightia morbosa* and *Gloeosporium perennans*. Fresh fruit from Chile, Argentina, and South Africa may be exempted from prohibition (*see* following section "Entry restricted").
2. Citrus fruit trees, parts thereof, fruit and fruit peel from all countries, on account of *Prontaspis* (*Unaspis*) *citri*, white fly (*Aleurodes*), *Pseudomonas* (*Xanthomonas*) *citri*, *Corticium salmonicolor*, *Gloeosporium limetticolum*, *Diplodia citri*, and tristeza disease. Citrus fruit from certain areas may be exempted from prohibition (*see* following section).
3. Solanaceous plants, parts of plants and fruits except tubers and seed, from all countries, on account of *Heterodera rostochiensis*, *Epitrix* spp. and virus diseases (*see* exemptions in following section).
4. Maize stems and ears from Africa, on account of *Busseola fusca* and other species and virus diseases.
5. Almonds in shell from all countries except Spain, on account of *Eurytoma amygdali* and *Ascochyta chlorospora* (*Gnomonia circumscissa*).
6. Cactaceae plants, parts thereof and fruits from all countries, on account of insects and diseases harmful to the Indian fig.
7. Living trees, parts thereof and seeds of oak (*Quercus* spp.) and of Chinese chestnut (*Castanea mollissima*) and oak timber from the U.S.A., on account of oak wilt (*Endoconidiophora fagacearum*). Timber which has been treated by vacuum and pressure process and is accompanied by an official certificate to this effect will be exempted from prohibition.
8. Beet plant and parts thereof (except glomerules) of all species from all countries, on account of virus diseases.
9. Coniferous trees and parts thereof (except seed) of the genus *Pseudotsuga* from all countries and of the genera *Abies*, *Pinus* and *Tsuga* from non-European countries, on account of needle cast of Douglas fir *Rhabdocline pseudotsugae*.
10. Organic fertilizers (except guano, peat and similar material), potted plants, plants with earth balls from non-European countries.

*Entry restricted.* The following plant materials may be imported into or transported through Italy only under the conditions specified below:

1. Potato tubers. Import and transit are permitted if the potatoes are free from earth and each shipment is accompanied by an official certificate attesting freedom from dangerous diseases and pests, particularly wart (*Synchytrium endobioticum*), ring rot (*Corynebacterium sepedonicum*) and cysts of *Heterodera rostochiensis*.
2. Beet glomerules. Import and transit are permitted if accompanied by a phytosanitary certificate stating that the glomerules originate from cultures free from beet yellows virus.
3. Coniferous plants and parts thereof (including seed) of the genera *Abies*, *Pinus* and *Tsuga* from European coun-

tries. Import and transit are permitted if accompanied by a phytosanitary certificate indicating their origin, freedom from dangerous diseases especially *Rhabdocline pseudotsugae*, scientific names, and other data useful for identification.

4. Potted plants or plants with earth balls, except the species specifically prohibited. Import is permitted from European countries if accompanied by an official certificate attesting freedom from dangerous diseases, particularly nematodes, bacteria and soil fungi.
5. Beans (*Phaseolus, Dolichos* and *Vigna* spp.). Import and transit are permitted, if accompanied by an official certificate attesting freedom from dangerous pests and diseases, particularly bacterial wilt (*Corynebacterium flaccumfaciens*).
6. Flowering plants and parts of plants, and ornamental bulbs, rhizomes and tubers. Import is permitted if accompanied by an official certificate stating that the plants are healthy and originate from fields found to be free from virus, bacterial and fungus diseases and nematodes.
7. Fresh fruits from Argentina. Only the following fruits may be imported or transported through the port of Genoa during the periods specified:
   Pears and apples: 1 February-30 June
   Quinces, peaches and plums: 1 January-31 May
   Grapes free from stems and leaves: 1 January-30 June
8. Fresh fruit from South Africa and Chile. Transit is permitted throughout the year, through the ports of Genoa, Venice and Trieste if from South Africa or through the port of Genoa only if from Chile.
9. Citrus fruit. Importation of citrus fruit from Tripolitania is permitted from 1 October to 31 March through the ports of Genoa, Naples, Venice and Trieste. Grapefruit from Somaliland may be imported throughout the year through the same ports, provided they are free from leaves and other parts of the plant and are fumigated on arrival.

   Transit of citrus fruit from any country is permitted from 1 December to 31 March through the ports of Genoa, Naples, Venice and Savona, provided they are wrapped in paper and packed in cases. They may be transported through the port of Trieste any time during the year.

   Citrus fruit in transit from Spain, Israel, Lebanon, Cyprus, Turkey, Greece, Syria, Egypt, Libya, Tunisia, Algeria, and Morocco may be admitted throughout the year through the ports mentioned above. In addition, citrus fruit from Spain may be admitted at the railway station of Ventimiglia.

   Each shipment destined for importation or transit must be accompanied by an official certificate attesting freedom from dangerous pests and diseases, and indicating consignor, forwarding agent, consignee, number of cases and its content, brand of the product, etc. The goods must be packed in solid cases carrying the brand mark of the producer.
10. Solanaceous plants. Importation of tomatoes, peppers and eggplants is permitted from Spain, Canary Islands, Israel, Egypt, Tripolitania, Eritrea and Morocco from 1 January to 28 February through the ports of Genoa, Naples, Venice and Trieste and Rome airport.

    Transit of the same vegetables from the above-mentioned countries is admitted from 1 December to 31 March through the ports of Genoa, Naples and Venice, and from any country at any time through the port of Trieste.

    The shipment must be accompanied by an official certificate attesting freedom from dangerous pests and diseases, particularly *Prodenia litura*, viruses and bacterial diseases.
11. Almonds in shell from Spain. Importation or transit is permitted through all the authorized custom offices, if each consignment is accompanied by an official certificate attesting freedom from dangerous pests and containing data for identification. In the case of consignments in bulk, forwarded by land, the railway wagons must be sealed and numbered by the Spanish Plant Protection Service. Consignment of less than one carload or shipped by sea must be packed in string containers sealed, numbered and properly labelled.
12. Table beetroots may be imported, only through the custom offices of Luino and Milan, if accompanied by an official certificate attesting freedom from dangerous pests. The consignments may not be in bulk. The beetroots must be washed and dried and after introduction cooked in the establishments near the custom offices.
13. Seeds of fodder plants. These may be imported if the absence of seeds of *Cuscuta* and other harmful plants has been verified by inspection on arrival. In the case of transit, entry may be

permitted after *Cuscuta* has been removed, in accordance with Law No. 987 of 18 June 1931.

*Importation by travellers.* The above prohibitions or restrictions will be applicable to plants or parts of plants, including seeds, brought in by travellers from abroad.

*Importation for scientific purposes.* The above prohibitions or restrictions do not apply to plant materials imported for study or experimentation with the authorization of the Ministry of Agriculture and Forestry.

*Plant materials not for propagation.* Plant products for consumption or industrial uses, except those specifically prohibited or restricted, may be imported through any customs office, provided that the provisions of Article 9 of Law No. 987 of 1931 are observed.

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Roma, 1958 — Tipografia del Senato del Dott. G. Bardi

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